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SOCIAL WELFARE IMPLICATIONS OF FEDERAL MARKETING ORDERS FOR FRUITS AND VEGETABLES

Edward V. Jesse

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SOCIAL WELFARE IMPLICATIONS OF FEDERAL MARKETING ORDERS FOR FRUITS AND VEGETABLES.
By Edward V. Jesse; Economics, Statistics, and Cooperatives Service; U.S. Department
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ABSTRACT

This report explores the effects on consumers and producers of terminating methods of supply management presently permitted through the use of Federal marketing orders for fruits, vegetables, and specialty crops. Changes in net social welfare are outlined both during the season controls are removed and after longer run production adjustments are completed, using linear demand and supply relationships. Empirical information necessary to appraise welfare changes is indicated where the direction of change is not apparent.

Keywords: Marketing orders, social welfare, size and grade standards, price stabilization, price discrimination

SUMMARY

Social welfare implications of Federal marketing orders for fruit, vegetable, tree nut, and specialty crops are explored. The analysis concludes that marketing orders can neither be condemned nor justified on the basis of their effects on social welfare.

Four methods of supply management authorized by marketing orders were analyzed: product quality standards, which may limit marketable supplies; market allocation, which includes mechanisms for exploiting separate markets with different elasticities of demand; producers' allotments, which may restrict output; and intraseasonal allocation, which controls the seasonal flow of products to market.

Prohibiting product quality standards would increase consumer surplus in the short run. Longrun changes in consumer surplus, however, as well as both shortrun and longrun changes in producer revenue depend on factors related to how supply and demand are altered by dropping quality restrictions.

Prohibiting price discrimination through market allocation provisions would increase consumer surplus in both the short run and the long run. This gain exceeds producer revenue in the short run, but it may not in the long run, depending on supply and demand elasticities.

While social welfare gains are possible by terminating producer allotment orders, which can effectively restrict total commodity supply, the two orders presently operating are not capable of restricting output because of competition from outside suppliers.

Prohibiting intraseasonal allocation would mean a net loss in social welfare to the extent that these provisions stabilize price and supply within a season. Since these provisions may also be used to allocate supplies among separate markets, however, their effects are analogous to market allocation programs.

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Social Welfare Implications of Federal Marketing Orders for Fruits and Vegetables

Edward V. Jesse 1/

INTRODUCTION

Once viewed benignly by all but those directly affected, Federal marketing orders authorized under the Agricultural Marketing Agreement Act of 1937 have recently moved near the center of the agricultural policy spotlight. These orders are being questioned by consumer groups and scrutinized by the Federal Trade Commission (FTC) and the Antitrust Division of the Justice Department because of their role in food price inflation. An FTC staff report summarizes recently voiced complaints about fruit and vegetable orders:

There are in marketing orders numerous examples of provisions with anticompetitive potential and effect. Entry barriers, import restrictions, flow-to-market regulations, market allocation -- all these are contrivances designed to keep price above what the market would establish if it operated freely. Moreover, there is evidence from statistical studies that prices have indeed been raised by marketing orders. Also, additional real costs are imposed by outright product destruction which artificially raises prices and leads to even greater production of unwanted surpluses which have to be disposed of, as well as by various technically inefficient aspects of market allocations, entry prevention, and flow-to-market regulations. (5, p. 179) 2/

Given marketing orders' objective of establishing parity prices to producers, conflicts between producer and consumer interests are inevitable. The critical questions concern the net benefits associated with marketing orders, and more important, whether the benefits are positive or negative. Do the contrivances cost consumers more than they yield farmers in the way of higher grower returns?

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2/ The statistical studies noted here are cited as internal U.S. Department of Agriculture studies. The product destruction noted here refers to the "green drop" provision of the California Cling Peach Order; this order, authorized under the California Marketing Act of 1937 rather than Federal legislation, no longer permits product destruction. Underscored numbers in parentheses refer to citations in the bibliography at the end of this report.

This report addresses these questions from a theoretical perspective. The specific objective is to appraise the social welfare implications of Federal marketing orders for fruit, vegetable, tree nut, and specialty crops. The report considers orders using three different forms of supply management -- quality restrictions, intraseasonal allocation, and seasonal allocation. Both shortrun and longrun effects of prohibiting the orders on a measure of social welfare are evaluated. The general direction of change is noted where possible, and in questionable cases, the information necessary to make an assessment is specified. The report does not develop any new theory or novel applications of existing theory. Its contribution lies in assembling appropriate analytical models and specifically applying them to marketing order operations.

This report is intended primarily for economists who structure and test hypotheses concerning marketing order effects. Other intended users include policy makers who monitor order operations, for which the report might serve as a guide to resource allocation.

PERSPECTIVE

The Federal marketing order program is a child of the Depression, resulting from Government efforts to increase and stabilize farm incomes in the thirties. ^{3/} The program was initially authorized in the Agricultural Adjustment Act of 1933 (AAA). Those parts of the AAA specifically relating to marketing agreements and orders were later amended and supplemented and reenacted as the Agricultural Marketing Agreement Act of 1937 (AMAA), which as amended is the basic enabling legislation. Several States enacted similar legislation about the same time. Many State orders with provisions similar to Federal orders are in effect, especially in California (6). This report considers only those orders authorized under the AMAA.

Both orders and agreements are authorized by the AMAA. While these programs are frequently spoken of together, there are significant differences. Both orders and agreements bind handlers to specified terms, but orders are mandatory while agreements are voluntary. Eligible commodities and permitted activities for orders are specified in the AMAA; no such restrictions exist for agreements. In actuality, both are typically used together and have identical terms. As used in this report, order implies both an order and any accompanying agreement.

While many commodities are eligible for marketing order coverage, Federal Orders are used only for milk and certain horticultural crops (fruits, vegetables, tree nuts, and hops). Order terms for milk differ substantially from those for other eligible commodities and are not considered here.

The AMAA specifies permitted marketing activities to achieve the orderly marketing objectives of the act. It also provides detailed procedures for initiation, amendment, and termination of orders. Most orders operate in about the same fashion. Prior to the beginning of the marketing season, a marketing order administrative committee consisting of producers and handlers establishes a marketing policy based on its appraisal of current and anticipated supply and demand conditions. Based on this marketing policy, recommended regulations affecting handling of the upcoming crop are proposed and submitted to the Secretary of Agriculture for approval. If approved, the regulations become binding on all handlers of the crop.

Order Provisions

Marketing activities permitted in fruit and vegetable orders can be broadly classed as quality control, quantity control, and general support. Quality control

^{3/} For an expanded discussion of marketing order operations, see (15), or (16).

provisions establish product quality standards, usually expressed in terms of minimum size or grade. Standards for shipping cartons and product placement also may be imposed. Quantity control measures that apply to both intraseasonal and seasonal supplies are authorized.

Intraseasonal plans attempt to allocate total supply evenly over the season to avoid gluts and shortages. Variants of intraseasonal allocation are used. Some orders permit periodic declaration of shipping holidays, periods during which handler sales are prohibited. Others, notably orders for California-Arizona oranges and lemons, control shipments on a consistent weekly basis by assigning handler prorates, or maximum sales quotas. These are termed flow-to-market provisions.

Provisions governing seasonal quantity control basically entail eliminating surplus production each season from primary markets, where surplus is defined by marketing order administrative committees. Three methods are used to eliminate surplus: market allocation, reserve pools, and producer allotments. Market allocation involves price discrimination. Primary and secondary markets are identified with relatively inelastic and elastic demands. In years when crops are large, sales in the primary market or markets are constrained, with excess supplies diverted to secondary markets. This causes secondary market prices to fall below prices in primary markets, but keeps weighted average returns for all sales above what they would be without market allocation.

Reserve pools are conceptually similar to market allocation. Primary market sales are administratively fixed through recommendations of the marketing order committee, and production declared as surplus is placed in a reserve pool. Pool contents may either be sold in secondary markets, disposed of in nonfood uses, or carried over to subsequent crop years for sale in the primary market.

With producer allotments, surplus is eliminated by regulating production rather than sales. Individual producers are assigned seasonal quotas based on production history. Marketing order administrative committees determine desirable sales which are subsequently expressed as a percentage of aggregate quotas. Each producer's marketing allotment is specified as the aggregate percentage applied to the individual quota.

General support activities authorized in Federal marketing orders for fruits and vegetables include: (1) Mandatory product inspection, (2) financing of production research, marketing research, and development projects, including advertising and other promotion activities for certain specified commodities, (3) prohibition of unfair methods of competition, and (4) mandatory price posting by handlers.

This report evaluates those authorized marketing order provisions which can be used to limit marketable supplies. These include the quantity control provisions that limit seasonal and intraseasonal supplies. Quality standards may also be used to limit supplies; size and grade minimums can be altered according to crop size, with more stringent standards applying to large crops. Provisions that limit supplies are termed supply management provisions in this report.

Nearly all existing fruit and vegetable orders specify size or grade standards (table 1). Seasonal allocation provisions pertain mainly to less perishable commodities, including all the covered tree nuts. Intraseasonal allocation provisions are used most heavily in citrus orders.

Method of Analysis

The basic forms of supply management permitted by fruit and vegetable marketing orders are analyzed from the standpoint of their effect on both consumers and pro-

Table 1--Supply management provisions of Federal
fruit and vegetable marketing orders 1/

Order number <u>2/</u> :	Commodity and area	Authorized supply management provisions <u>3/ 4/</u>		
		Grade and/or size	Intraseasonal allocation	Seasonal allocation
	Fruit:			
905	Florida citrus	G,S	H	--
906	Texas oranges and grapefruit.	G,S	<u>5/</u>	--
907	California-Arizona navel oranges	S	F	--
908	California-Arizona valencia oranges	S	F	--
909 <u>6/</u>	California-Arizona grapefruit	G,S	--	--
910	California-Arizona lemons	S	F	--
911	Florida limes	G,S	H,F	--
912	Indian River (Florida grapefruit)	--	F	--
913	Florida Interior grapefruit	--	F	--
915	Florida avocados	G,S	H	--
916	California nectarines	G,S	--	--
917	California pears, plums, and peaches	G,S	--	--
918	Georgia peaches	G,S	--	--
919	Colorado peaches	G,S	--	--
921	Washington peaches	G,S	--	--
922	Washington apricots	G,S	--	--
923	Washington sweet cherries	G,S	--	--
924	Washington-Oregon fresh prunes	G,S	--	--
925	Idaho-Oregon fresh prunes	G,S	--	--
926	California Tokay grapes	G,S	H,P	--
927	Pacific Coast winter pears	G,S	--	--
928	Hawaii papayas	G,S	--	--
929	Cranberries, 10 States	<u>7/</u>	--	R,A
930 <u>6/</u>	Tart-Cherries, eight States	<u>7/</u>	--	R
931	Washington-Oregon Bartlett pears	G,S	--	--
932	California olives	G,S	--	--
	Vegetable:			
945	Idaho-East Oregon potatoes	G,S	--	--
946	Washington potatoes	G,S	--	--
947	South Oregon-North California potatoes	G,S	--	--
948	Colorado potatoes	G,S	--	--
950	Maine potatoes	G,S	--	--
953	Virginia-North Carolina potatoes	G,S	--	--

Continued--

See footnotes at end of table.

Table 1--Supply management provisions of Federal
fruit and vegetable marketing orders 1/--Continued

		Authorized supply management provisions <u>3</u> / <u>4</u> /		
Order number <u>2</u> /:	Commodity and area	Grade and/or size	Intraseasonal allocation	Seasonal allocation
Vegetable:				
958	Idaho-East Oregon onions	G,S	H	--
959	South Texas onions	G,S	H	--
965 <u>6</u> /	Rio Grande Valley (Texas) tomatoes	G,S	--	--
966	Florida tomatoes	G,S	--	--
967	Florida celery	G,S	H,F	A
971	South Texas lettuce	G,S	H,F	--
Dried fruits, nuts, horticultural specialties:				
981	California almonds	<u>7</u> /	--	M
982	Oregon-Washington filberts	G,S	--	M
984	Pacific Coast walnuts	G,S	--	M
987	California dates	G,S	--	M
989	California raisins	G,S	--	M,R
991 <u>6</u> /	Idaho, Washington, Oregon, and California hops	G	--	R,A
993	California prunes	G,S	--	R

-- = Not applicable.

1/ Orders effective July 1, 1978. Marketing agreements accompany all orders except those noted.

2/ Order number refers to Code of Federal Regulations section. For example, order No. 905 is codified as 7 CFR 905.

3/ Authorized provisions may not necessarily be employed in some years.

4/ G = minimum grade requirement; S = minimum size requirement; M = market allocation provision; R = reserve pool provision; A = producer allotment provision; H = shipping holiday; F = flow-to-market.

5/ Restricting handler deliveries is specifically prohibited.

6/ Order only; no marketing agreement.

7/ Grade and size specifications apply only to restricted portion of crop.

Sources: (6 and 15).

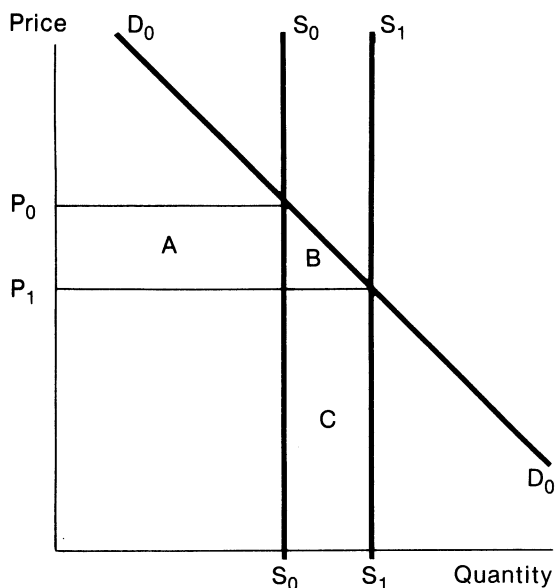
ducers. Initially, a specific supply management provision is assumed in effect. Then, use of the provision is banned. Associated shortrun and longrun supply, demand, and price adjustments result in changes in consumer surplus and producer gross volume. The sum of these two changes is defined as the net change in social welfare.

Consumer surplus is conventionally measured as the area under the demand curve and above the price line. The problems of using consumer surplus measured in this way as an indicator of consumer well-being are well documented (8); these problems are reduced by considering changes in surplus rather than absolute amounts. Typically, producer surplus, measured as the area above the supply curve and below the price line, is used to indicate producer well-being. This concept is not applicable in the shortrun when supply is completely inelastic; producer revenue is used to represent producer well-being. Since the analysis is cast in terms of changes, the substitution does not greatly modify net social welfare measurement.

Suppose that terminating an order provision results in a change in shortrun supply from S_0 to S_1 (figure 1). Demand is unchanged at D_0 , yielding a price decrease from P_0 to P_1 . The area A + B represents gain in consumer surplus. The net change in producer returns (that is, total revenue) is the area C less the area A. The change may be positive or negative, depending on elasticity of demand. Net social welfare change is the sum of the changes in consumer surplus and producer revenue, or B + C. In this example, terminating the order would yield a positive net gain in social welfare.

Limitations

FIGURE 1
Net Social Welfare Change Calculation



Change in consumer surplus	= ΔCS	= A + B
+ Change in total revenue	= ΔTR	= C - A
= Change in net social welfare	= ΔNSW	= B + C

Marketing orders are depicted as institutions which permit perfect control in a theoretical sense. One must bear in mind the abstract nature of their analysis. The degree of control permitted in real life is quite imperfect, as noted by Farrell (4, p. 302):

However, while a marketing order is a monoploid device, it does not create a monopoly in the technical economic sense. There are very real constraints in the enabling statutes in the manner and extent to which a group of producers may exercise market control; there are very real economic constraints on both the supply and demand side of the markets for farm products which preclude monopoly. In assessing the economic implications of marketing orders for producers, processors, handlers, and consumers, these constraints must be clearly recognized.

Analysis is also limited by use of linear supply and demand relationships. This simplifies evaluation of social welfare changes, but may be a severely restrictive

representation of real life conditions. In some cases, conclusions may be dissimilar for different functional forms.

Finally, the analysis ignores important questions concerning income redistribution and resource allocation effects of marketing orders. No attempt is made to assess either the desirability of income transfers attributable to order operations or the opportunity costs of resources used in producing order commodities. These are critical questions beyond the scope of this report.

GRADE AND SIZE RESTRICTIONS

Minimum standards for grade, size, and maturity (usually as related to size) are common in Federal marketing orders for fruits and vegetables--35 orders provide for restricting marketings to certain sizes or U.S. Department of Agriculture grades. In some cases, specified standards are constant from year to year, reflecting some perceived basic level of quality. In other cases, standards are altered both within a season and from one season to the next in response to crop size and quality. The effect of quality restrictions is to reduce supplies by the amount that producers would otherwise place on the market. 4/

Shortrun Effect

In the shortrun (single season), quality specifications can be viewed in terms of how they alter the position of fixed supply and demand curves. 5/ The demand curve's position in two-dimensional price-quantity space depends on conventional demand shifters (such as income, prices of substitutes and complements, and tastes and preferences), as well as the average quality of offerings. Increases in average quality shift demand to the right. 6/

Specifying the effect of quality on demand in this fashion follows procedures employed by Price (10) and Shafer (12). Alternatively, it may be argued that a single demand curve is inappropriate when several grades are involved--separate demands for each grade exist, and restrictions affect only the supply of specific grades (4, p. 311). While this argument has merit, grade identities are lost at the retail level. Wholesale and retail purchasers may buy on the basis of grade specifications, but consumers observe a homogeneous product on display. Hence, it does not seem appropriate to specify separate derived demand curves.

Dropping quality standards imposed by a marketing order alters the demand function through its effect on average quality. Quality decreases, shifting demand to the left. The nature of this shift is open to speculation. There is ample reason to suggest that the new demand curve would lie below the original curve at all points; the quality composition of any quantity is reduced and should be discernible to consumers. The slope of the revised demand curve relative to the original is unknown. The aggregative nature of the specified demand function precludes considering how income or other segments might be differentially affected by any quality change. For simplicity, only a parallel shift is examined in detail.

4/ In most cases, restricted quantities are diverted to secondary markets (primarily processing) rather than culled.

5/ Demand curves are assumed to reflect derived demand at the producer level.

6/ This assertion could be cast as a testable hypothesis, but the question of how well existing grades and standards reflect consumer preferences will not be considered here (see 3, 13).

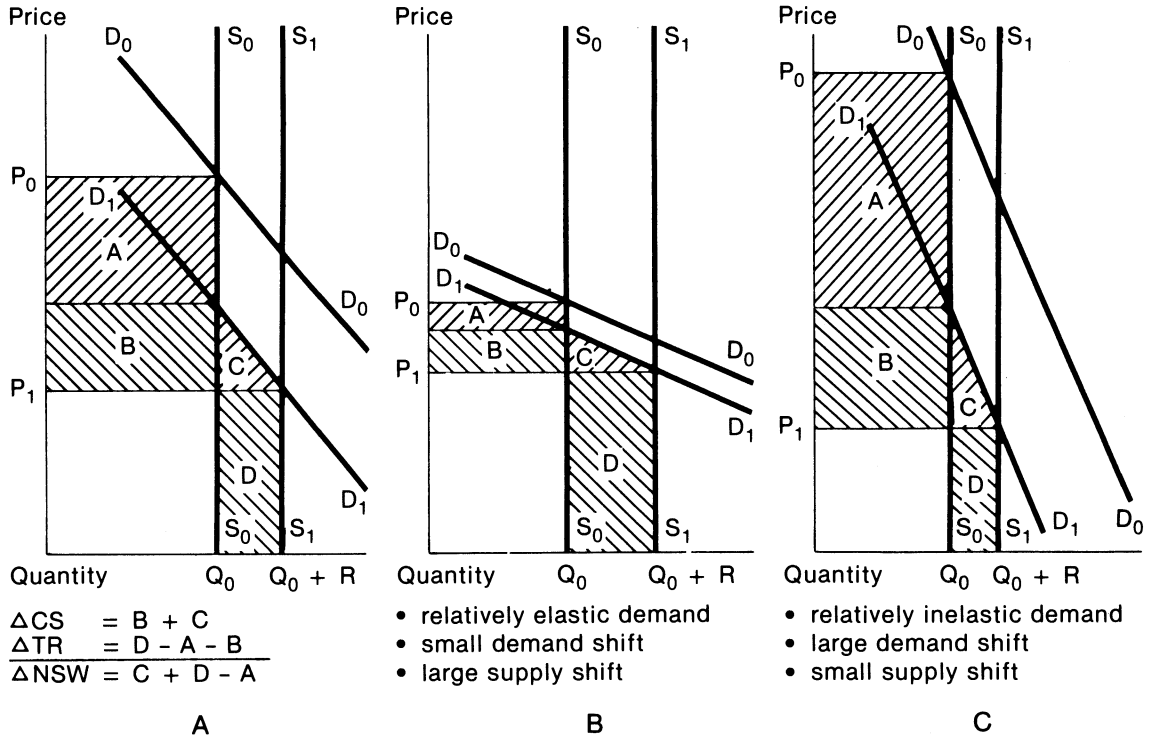
The shortrun commodity supply curve is totally inelastic. Defining M grade and N size categories in total with m and n the minimum grade and size specifications, aggregate supply, Q^S , with the order in effect is:

$$Q^S = \sum_{i=m}^M \sum_{j=n}^N Q_{ij}$$

where Q_{ij} is quantity in each of the $(M - m + 1) \times (N - n + 1)$ grade-size categories.

From an initial situation where quality (size and/or grade) restrictions are imposed, price, output, and consumer surplus changes on dropping the restrictions can be evaluated. In the initial case, D_0D_0 in figure 2A is the demand curve for the restricted quality mix and S_0S_0 is the fixed (restricted) supply. Quantity Q_0 clears the market at price P_0 . Removing the quality restriction shifts the demand curve to the left (D_1D_1), with the nature and magnitude of the shift dependent on the relationship between demand and average quality.

FIGURE 2
Shortrun Changes in Social Welfare from Terminating Marketing Order Quality Restrictions



Supply is shifted to the right by the amount of previously restricted fruit which can now be marketed. This shift is shown as (figure 2A):

$$R = \sum_{i=1}^{m-1} \sum_{j=1}^{n-1} Q_{ij}$$

The revised supply and demand curves yield a new market clearing price of $P_1 < P_0$.

With the parallel demand shift, the change in consumer surplus resulting from prohibiting the quality restriction is the shaded area $B + C$ (figure 2A). This change is associated entirely with the shift in supply, since with no change in supply, consumer surplus is unaltered by parallel shifts in demand. The magnitude of the consumer surplus change varies directly with R --the more severely restricted is supply, the more consumers will benefit from relaxing the restriction. ^{7/}

The change in total revenue from dropping quality restrictions is represented in fig. 2A by the areas $D - A - B$. Net social welfare change is the sum of consumer surplus and revenue changes, or $C + D - A$. Hence, whether prohibiting quality standards will yield a net gain or loss depends on the size of area A relative to $C + D$. This, in turn, depends on three factors: (1) Price elasticity of demand, (2) magnitude of the shift in demand (that is, the relationship between demand and average quality), and (3) the magnitude of the supply shift (the proportion of total supply restricted by the quality standards).

Figures 2B and 2C illustrate extreme cases. With relatively elastic demand, a small shift in demand and a large shift in supply, prohibiting quality standards increases net social welfare. A relatively inelastic demand combined with a large shift in demand and a small supply increase leads to a reduction in net social welfare.

The relative magnitudes of supply and demand shifts upon lifting quality standards highlight the critical role of grades and standards in reflecting consumer desires. If consumers perceive little difference in quality, removal of quality standards is likely to benefit them substantially more than producers are hurt. On the other hand, if standards are accurate indicators of consumers' quality perceptions, then enforcement of these standards, whether or not through marketing orders, is more likely to be socially beneficial.

Two conclusions are important from the standpoint of evaluating marketing orders utilizing grade and size restrictions. First, prohibiting restrictions permits a larger quantity to be marketed at a lower price during the season the restriction is terminated. The nature of the demand and supply curve shifts ensures this result. Consequently, consumers would unquestionably gain from removing quality restrictions. Second, the combined impact on producers and consumers together is indeterminate in the absence of data concerning the elasticity of demand and the magnitude of shifts in demand and supply. Permitting lower quality produce to be marketed reduces prices below what they would be with marketing order restrictions. Unequivocal conclusions concerning social welfare, however, cannot be made without either knowledge of supply and demand relationships, including the effect of quality on demand, or assumptions concerning the equity or propriety of various forms of income distribution.

Longrun Effect

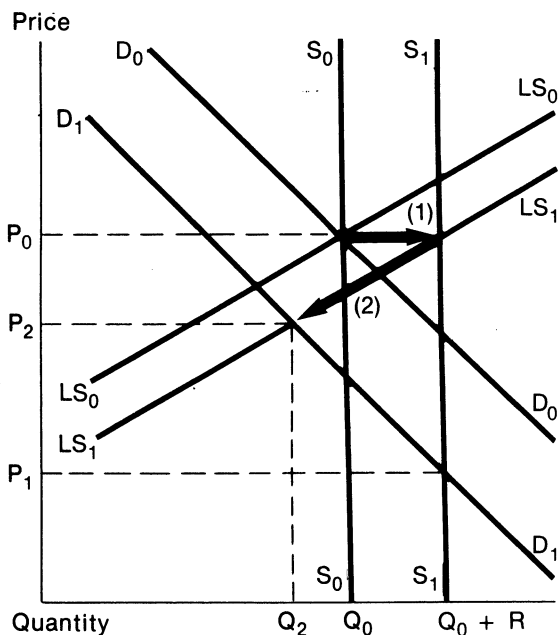
The shortrun effect on net social welfare of removing minimum grade and size standards was shown to be indeterminable without knowledge of how these standards affect demand and the stringency of the specifications. The assessment problem becomes even more complicated when longrun implications are considered.

Figure 3 shows longrun supply curves for a commodity initially produced under a marketing order specifying minimum quality standards. The curves have nonzero elasticity, permitting interseasonal production response to price. LS_0 is initial long-

^{7/} Nonparallel shifts are more difficult to evaluate. In general, if the slope of D_1D_1 is greater than D_0D_0 , the change in consumer surplus will be greater than with the parallel shift and conversely.

run supply, and LS_1 is longrun supply with quality restrictions removed. The arrows indicate changes with the removal of the restriction. Initially, supply shifts to the right as producers can make the previously restricted quantities at any given price (shift 1). In the longrun, there is a movement along the new supply curve to the equilibrium position (dictated by the shifted demand curve) at P_2Q_2 (shift 2).

FIGURE 3
Longrun Changes in Supply and Demand from Terminating Marketing Order Quality Restrictions



The new equilibrium price, quantity, and resulting consumer surplus, producer revenue, and net social welfare relative to initial values are indeterminable without additional information including: longrun elasticity of supply, elasticity of demand, demand-quality relationship, and distribution of grades by exiting and remaining producers. However, as shown in figure 2, the new equilibrium position could occur at a point such that both consumer surplus and producer revenue would be less than it would be with marketing order quality restrictions. This contrasts with the shortrun case where the change in consumer surplus caused by terminating quality standards was always positive.

INTRASEASONAL ALLOCATION ^{8/}

Thirteen fruit and vegetable marketing orders authorize control of the seasonal flow of products to market (table 1). Of these, three permit only shipping holidays--specified periods during which no commodity shipments may be made. Five orders permit the periodic assignment of prorates to shippers. These prorates are proportionate shares of maximum total

industry shipments. The restriction applies to a week or some other specified time period. Five orders permit holidays and prorates.

Two features of these flow-to-market orders complicate assessment of welfare effects. First, some of these orders provide for both quality restrictions and seasonal allocation provisions as well as intraseasonal allocation plans. Consequently, pure effects do not exist. Use of prorates for a large part of a season may also be closely equivalent to seasonal control. If harvested production during a prorate period substantially exceeds the prorate and storage is not feasible, then fruit eligible for regulated market sale must be diverted to unregulated outlets. ^{9/}

Second, the precise intent of flow-to-market order administrative committees is not clear. While price and supply stability is one objective, committees also must consider ripening schedules, demand variability, producer equity, competing supply areas, and numerous other factors. Regardless, implications concerning the welfare

^{8/} This analysis also applies to seasonal allocation provisions which employ a reserve pool to equalize sales over two or more successive seasons.

^{9/} Rausser (11, p. 250) argues that flow-to-market order provisions for California-Arizona citrus imply seasonal supply control. Shipments following termination of controls are predetermined. Further, the control period approximates tree storage life, and production exceeding weekly prorates must be directed into processing channels.

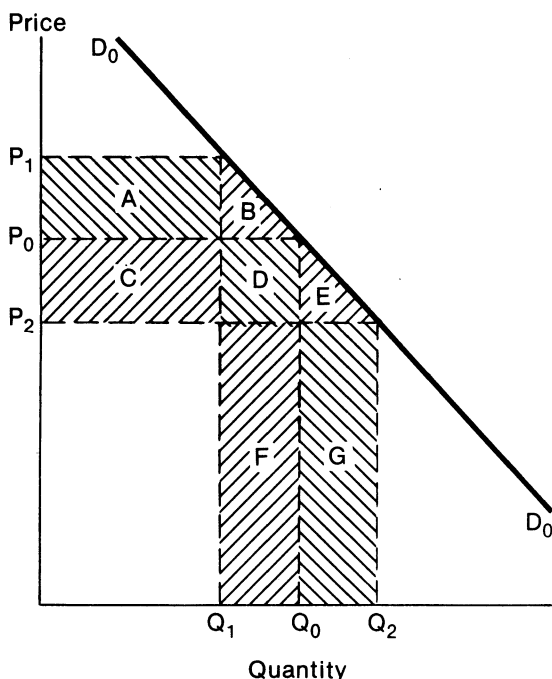
effects of orders using intraseasonal allocation can be demonstrated by making some simplifying assumptions. In the following assessment, it is assumed that the objective of such orders is to distribute a fixed seasonal supply across equal time intervals characterized by identical derived demand relationships.

Consider a fixed supply, Q_T , which is to be allocated over two equal intervals within a season. Demand is assumed identical in each season, and is represented by $D_0 D_0$ (fig. 4). With stabilization through a flow-to-market order, the quantity $Q_0 = Q_T/2$ is sold in each time period at price P_0 . Now, assume order stabilization of sales is prohibited, and that uncontrolled methods of distributing Q_T , the fixed supply, lead to allocations of Q_1 and Q_2 in periods 1 and 2, respectively, with resulting prices of P_1 and P_2 . Note that:

$$\frac{Q_1 + Q_2}{2} = Q_0 \text{ and } \frac{P_1 + P_2}{2} = P_0,$$

so that positive and negative sales and price deviations from the stabilized case are equal.

FIGURE 4
Shortrun Changes in Social Welfare
from Terminating Flow-to-Market
Order Provisions



During the market shortage period when Q_1 is sold, changes in consumer surplus, producer revenue, and net social welfare from the stabilized case are:

$$\begin{aligned} \Delta CS_1 &= -A-B \\ + \Delta TR_1 &= A-D-F \\ \hline &= \Delta NSW_1 = -B-D-F \end{aligned}$$

During the glut period:

$$\begin{aligned} \Delta CS_2 &= C+D+E \\ + \Delta TR_2 &= G-C-D \\ \hline &= \Delta NSW_2 = G+E \end{aligned}$$

Noting the equal areas in figure 3:

$$\begin{aligned} \Delta CS_1 + CS_2 &= -A-B+C+D+E = D \\ + \Delta TR_1 + TR_2 &= A-D-F+G-C-D = -2D \\ \hline &= \Delta NSW_1 + NSW_2 = -B-D-F+G+E = -D \end{aligned}$$

The shortrun effect of terminating marketing orders which successfully stabilize shipments can be summarized as follows. Consumers gain from instability. From casual inspection of figure 4, this gain goes up at a steadily increasing rate with the amount by which the destabilized sales pattern deviates from constant period sales. Producer revenue losses are twice the amount of consumer gains, leading to net social welfare loss exactly equal to the gain in consumer surplus. Ignoring

distribution effects, this suggests that flow-to-market orders cannot be condemned for reducing societal welfare, at least on the basis of their supply and price stabilizing impact.

In the longrun, potential losses from destabilization are even larger. Even though the shortrun simple average price in the two-period case is the same before and after termination of the flow-to-market order, total revenue, and hence average revenue to producers is reduced by order termination. This suggests that when production adjustments to the revised price are made, seasonal supplies will be reduced, further reducing net social welfare as measured here.

This treatment of the welfare effects of price stability is admittedly superficial and ignores recent theoretical work in the general area (see, for example, 14). But this lack of sophistication does not invalidate the main conclusion: in both the shortrun and the longrun, termination of marketing orders which prevent seasonal shortages and gluts would tend to penalize producers more than consumers are benefited.

SEASONAL ALLOCATION

Three methods of supply management through control of aggregate seasonal sales were defined earlier. Market allocation plans, which administratively distribute sales among separable markets, are used in Federal marketing orders for three tree nuts, raisins, and dates (see table 1). Producer allotment plans limit aggregate supply by restricting marketings of individual suppliers. Producer allotments have been used in orders for hops and Florida celery. Use of allotments in the cranberry order has been authorized, but the authority has never been implemented. Reserve pool plans used for raisins, hops, tart cherries, and cranberries initially may hold back some supplies from the primary market. The reserve may be sold in the current or subsequent crop year through either the primary or secondary channels, depending on supply and price conditions. If the reserve is diverted to secondary outlets, the effects on social welfare are analytically equivalent to market allocation. Pool disposal in the current or subsequent year's primary markets can be analyzed in the same fashion as intraseasonal allocation. Consequently, only market allocation and producer allotments are considered below.

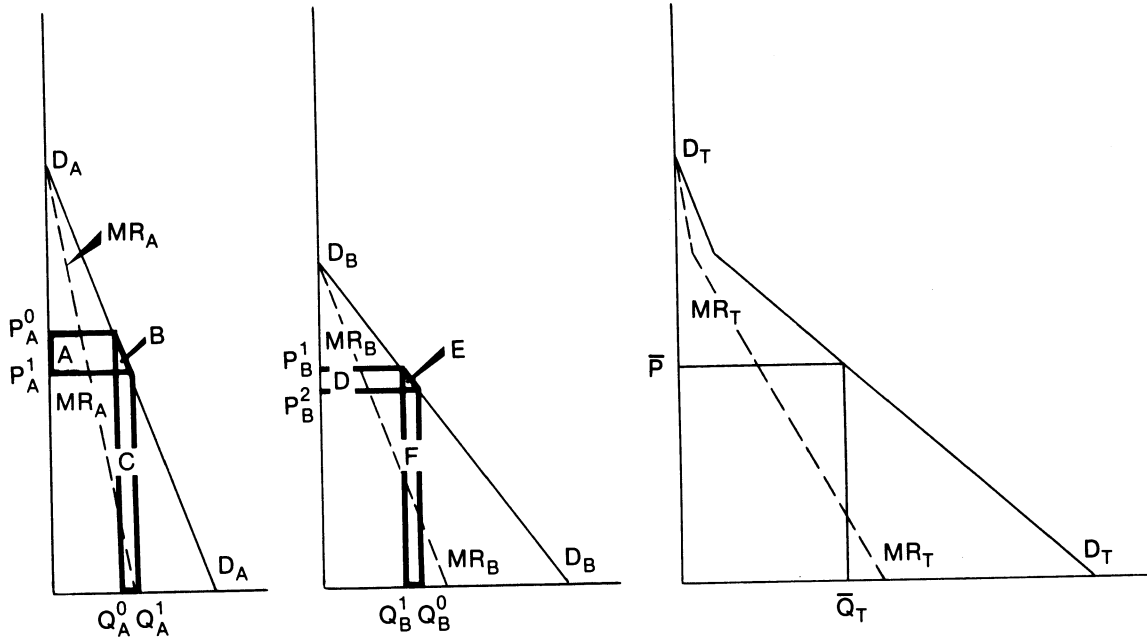
Market Allocation

Supply management through market allocation involves assigning production to alternative markets, taking advantage of spatial or product form separability among markets with different elasticities of demand. In an abstract sense, the order administrator acts as a discriminating monopolist, allocating total supply in an attempt to equate marginal revenues in the separate markets. According to critics, this leads to elevated prices (relative to no order) and to the general detriment of consumers (4, p. 5; 9, p. 1). However, since the monopolist does not control production (supply), the situation deviates from the classic case. 10/ Specifically, resource allocation attributable to output restriction through monopoly is absent; losses result solely from monopolistic allocation procedures.

Figure 5 illustrates market allocation in a two-market case. D_A and D_B are demand curves in markets A and B, respectively, and D_T is total demand, the horizontal summation of D_A and D_B . Similarly, MR_A , MR_B , and MR_T are individual market and aggregate marginal revenue curves. With market allocation, \bar{Q}_T ,

10/ Gaumnitz and Reed (7, p. 125) define exploitation of markets in this fashion as commodity price discrimination to distinguish it from classical price discrimination.

FIGURE 5
Shortrun Changes in Social Welfare from Terminating Market Allocation via
Marketing Orders



fixed shortrun (single-season) supply, is allocated to markets A and B so as to equate marginal revenues. This yields market supplies of Q_A^0 and Q_B^0 , which clear the respective markets of prices of P_A^0 and P_B^0 .

If market allocation is prohibited, the market prices would equalize at $P_A^1 = P_B^1 = \bar{P}$, which is determined from the intersection of \bar{Q}_T and the aggregate demand curve, D_T . New equilibrium quantities in the individual markets are $Q_A^1 (> Q_A^0)$ and $Q_B^1 (< Q_B^0)$.

The shaded areas in figure 5 correspond to changes in consumer surplus and total revenue with the termination of market allocation. Consumer surplus changes are:

$$\begin{aligned}
 \Delta CS_A &= A + B \\
 + \Delta CS_B &= -D - E \\
 \hline
 &= \Delta CS_T = A + B - D - E
 \end{aligned}$$

Changes in total revenue are:

$$\begin{aligned}
 \Delta TR_A &= C - A \\
 + \Delta TR_B &= D - F \\
 \hline
 &= \Delta TR_T = C - A + D - F
 \end{aligned}$$

The net change in social welfare is calculated as:

$$\begin{aligned}\Delta CS_T &= A + B - D - E \\ + \Delta TR &= C - A + D - F \\ = \Delta NSW &= B + C - E - F\end{aligned}$$

Since \bar{Q}_T is the same in the shortrun with and without market allocation, changes in quantities supplied to the individual markets must be identical-- $Q_A^1 - Q_A^0 = Q_B^0 - Q_B^1$. Consequently, the area C is exactly equal to the area F + 2E. Substituting this relationship into the expression for change in net social welfare yields:

$$\Delta NSW = G + C - E - F = B + F + 2E - E - F = B + E$$

Hence, prohibition of market allocation leads to an increase in net social welfare. This important conclusion holds regardless of the shapes of the individual market demand curves, as long as they are not identical.

The net increase in social welfare upon termination of market allocation controls results from an increase in consumer surplus which outweighs producer revenue losses by a factor of 3 to 2 (see appendix). The revenue loss is attributable to a reduction in weighted average revenue for all units sold, that is:

$$\left[P_A^0 Q_A^0 + P_B^0 Q_B^0 \right] \div \bar{Q}_T \text{ exceeds } \bar{P}.$$

With a reduction in average returns, growers would reduce supplies in crop years following termination of market allocation through marketing orders. Consequently, the longer run implications of prohibiting market allocation depend on the extent to which production is cut back.

The longrun effects are illustrated in figure 6. The aggregate demand curve, $D_T D_T$, is the same as in figure 5. In the shortrun, distribution of quantity \bar{Q}_T to markets A and B if price discrimination exists yields an average return to producers equal to:

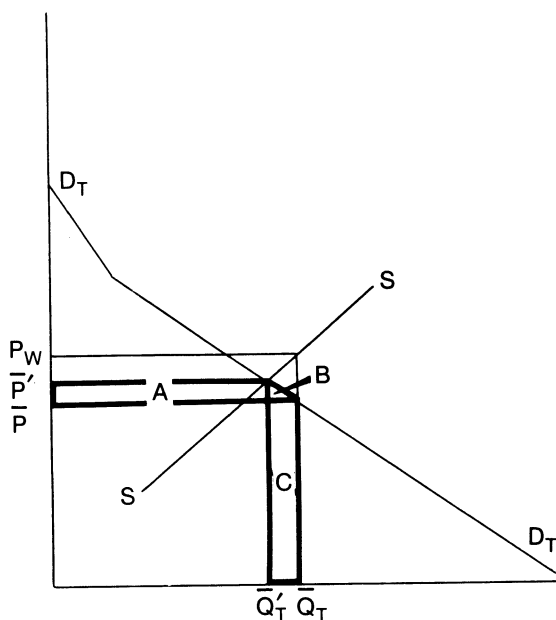
$$P_W = \left[P_A^0 Q_A^0 + P_B^0 Q_B^0 \right] \div \bar{Q}_T.$$

Hence, (P_W, \bar{Q}_T) represents one point on the longrun producer supply curve, shown in figure 6 as SS. While this is an equilibrium position with the marketing order in effect, termination of the order creates a temporary disequilibrium. Market price drops initially to \bar{P} , with the revised equilibrium of the intersection of SS and $D_T D_T$. At the new equilibrium, quantity $\bar{Q}_T^1 (< \bar{Q}_T)$ is produced at price \bar{P}' ($P < P' < P_W$).

The change in net social welfare moving from the shortrun to the longrun equilibrium can now be evaluated. As price is equal in both markets, the change in consumer surplus, ΔCS , is $-(A + B)$. Total revenue change, ΔTR , is $A - C$, yielding a negative change in net social welfare, ΔNSW , of $-(B + C)$.

It is not clear from the diagrams whether this negative change in net social welfare between the shortrun and longrun exceeds or falls short of the positive change on initial termination of market allocation. The conditions under which the overall change is positive or negative are outlined in the appendix. Specifically, net social welfare in the longrun will be reduced if both supply and aggregate demand are relatively elastic. This would appear to be an important result: contrary to what happens

FIGURE 6
Longrun Changes in Net Social Welfare
after Adjustment to Termination of
Market Allocation



Assuming the independent decisions of producers would result in a competitive equilibrium, prohibition of producer allotments leads to a revised solution, P_1Q_1 , dictated by the intersection of SS and DD. ^{11/} The change in consumer surplus from the monopolistic solution is $\Delta CS = A + B$. Producer revenue changes by $\Delta TR = C - A$, with a resulting gain in net social welfare at $\Delta NSW = B + C$.

The magnitude of the gain in net social welfare from terminating producer allotments depends on the degree of monopolistic output restriction. This, in turn, depends on the elasticity of producer supply. Extremes can be appraised by pivoting SS about its point of intersection with marginal revenue and noting the changes in area $B + C$. If supply is totally inelastic (SS is vertical), price and quantity will not change when producer allotments are terminated. Consequently, ΔCS , ΔTR , and ΔNSW are all zero. If supply is totally elastic (SS is horizontal), the price decline with termination of allotments is very large, as is the gain in net social welfare.

With producer allotment provisions, management through marketing orders can redistribute benefits to the net detriment of society. The loss in net social welfare depends on the extent to which allotments make monopolistic output restriction possible.

CONCLUSIONS AND IMPLICATIONS

Table 2 summarizes social welfare effects of terminating each of the supply management provisions permitted in Federal marketing orders for fruits, vegetables, and

^{11/} This is, of course, a longrun equilibrium position. In the shortrun, output is fixed, and disallowing allotments would not affect price. Note that marketing order allotment provisions can be (and typically are) used jointly with other supply management provisions. Allotment programs are considered independently here.

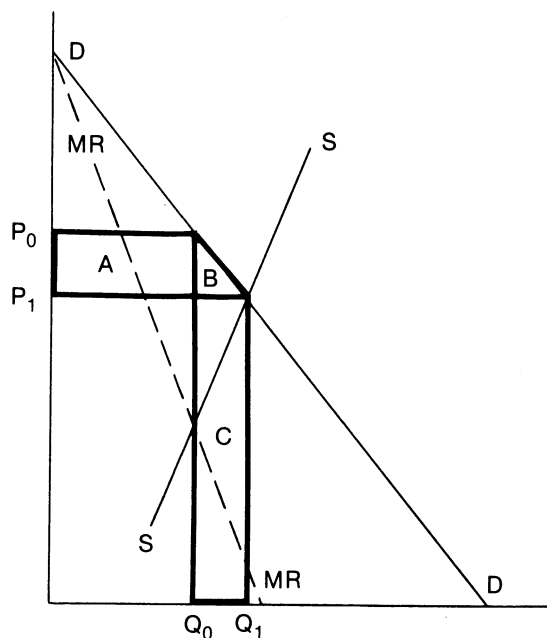
in the shortrun, one cannot conclude that prohibiting market allocation provisions in marketing orders will unequivocally lead to an increase in social welfare. Longer run supply and price adjustments will yield an increase in consumer surplus, but reduced producer revenue may exceed this gain.

Producer Allotments

Supply management through assignment of individual producer marketing allotments permits substantially more marketing control than do price discrimination provisions. Producers can attempt to act collectively as a monopolist to restrict output to levels of maximum profit.

Welfare implications of producer allotments can be assessed through figure 7. The initial monopolistic equilibrium position is indicated by quantity Q_0 clearing the market at price P_0 . Monopolistic output is determined by the intersection of aggregate supply SS, and the marginal revenue curve associated with the market demand curve, DD. The supply curve is the sum of individual producers' marginal cost curves.

FIGURE 7
Longrun Changes in Social Welfare from
Terminating Producer Allotment
Marketing Orders



specialty crops. Both shortrun and longrun changes in consumer surplus, producer revenue, and net social welfare are identified.

In the shortrun, removing quality standards imposed by marketing orders would increase quantity sold but would reduce the overall quality of aggregate marketings. Consumers benefit from the increased supplies regardless of the revised quality composition, but producer revenue losses may be large enough to outweigh consumer gains. Hence, the change in net social welfare is uncertain. A definitive appraisal would require knowledge of (1) the extent to which the commodity demand curve shifts to the left with decreases in average quality, (2) the amount of otherwise marketable production which is not sold because of quality standards, and (3) elasticity of demand.

The longrun effects of terminating marketing order quality standards hinge on supply adjustments made by producers in response to lower season average prices. Supply could shift to the left far enough to reduce consumer surplus below levels with

standards in effect, but longrun changes in net social welfare are indeterminate without information to evaluate the shortrun changes as well as knowledge of supply response characteristics.

A critical assumption employed in the assessment of quality standards is that demand shifts in a parallel fashion in response to changes in product quality. This

Table 2 --Theoretical welfare effects of prohibiting supply management^{1/} policies authorized under Federal fruit and vegetable marketing orders

Order provision	Shortrun			Longrun		
	Consumer surplus	Producer revenue	Net social welfare	Consumer surplus	Producer revenue	Net social welfare
Quality standards	+	?	?	?	?	?
Intraseasonal allocation	+	-	-	?	-	-
Seasonal allocation:						
Market allocation	+	-	+	+	-	?
Allotments	NC	NC	NC	+	-	+

^{1/} + = gain from dropping older

- = Loss

NC = No change

? = Effect not known without additional information.

precludes consideration of possible interrelationships between price and quality. Moreover, specifying a single market demand curve does not permit evaluation of how different income groups might be affected by removing marketing order quality standards. However, the analysis strongly suggests that individual market supply and demand characteristics must be clearly identified to properly appraise the welfare effects of abolishing size and grade provisions.

Terminating price and output stabilization through intraseasonal allocation plans would benefit consumers in the shortrun, but producer revenue losses would more than offset consumer gains. In the longrun (after producers' adjustment to lower season average weighted prices), consumer welfare may be smaller or larger than it would be with stabilization, depending on supply elasticity.

These conclusions concerning the effect of terminating stabilization provisions assume that prorates and shipping holidays are used solely to even out supplies over the marketing season. If these provisions allow a limitation on aggregate supplies, their effects on welfare are analogous to market allocation schemes. This analysis, like that of quality provisions, also fails to differentiate the effects on income classes.

Two forms of seasonal allocation through marketing orders were considered. Termination of market allocation, or allocating total seasonal supplies among separable markets based on principles of price discrimination, would benefit consumers in both the shortrun and the longrun. Producers lose in both cases. The effect on net social welfare is positive in the shortrun and uncertain in the longrun. Longrun changes would depend on the elasticities of both supply and demand.

Market allocation involves implicit taxes and subsidies. Consumers are taxed through higher prices to subsidize producers. Consumers in markets with relatively inelastic demand are taxed to provide subsidies to consumers in markets with elastic demand. This analysis ignores distribution effects in appraising welfare changes. Identifying which income groups are taxed and which are subsidized may be more important in assessing welfare implications than the actual values involved. Blanket condemnation of marketing orders which allocate unrestricted supplies among alternative markets does not appear appropriate, however, in terms of aggregate welfare effects.

An opposite conclusion may be drawn in the case of the second form of seasonal allocation considered. Producer allotments, to the extent that they are capable of restricting output through monopoly, are unequivocally detrimental to social welfare.

It must be emphasized, however, that the market structures for the two commodities covered by producer allotment orders are not monopolistic. Celery production under the Florida order comprises only about a quarter of U.S. supplies, and Florida encounters heavy competition from California and other producing areas even during the peak of its marketing season. While all U.S. hop production is under order, one-quarter to one-half of domestic hop use is from imports. Hence, the demand curve faced by producers of these order commodities is not the domestic market demand curve. Attempts to restrict output through monopoly would be foiled by increased production from unaffected suppliers. The analysis of welfare effects, while theoretically instructive, is not really applicable to the existing examples of marketing order programs using producer allotments.

Conclusions concerning the other types of supply management strategies employed under marketing orders are also based on the assumption that marketing order administrative committees are capable of exercising the degree of control implied in the theoretical models. This seems dubious--one would hardly expect the Almond Marketing

Board, for example, to precisely equate marginal revenues in foreign and domestic almond markets. Hence, it is important to recognize these theoretically based conclusions as hypotheses subject to empirical testing.

Other real-life conditions are substantially less clear-cut than the simplified models imply. The abstractions mask several complicating factors, including two or more provisions used simultaneously, lack of or imperfect knowledge of market information, nature of alternative markets, distribution effects, and a host of others. The analysis strongly suggests, however, that fruit and vegetable orders cannot be condemned or justified in toto on the basis of their welfare effects without specific data relating to market characteristics.

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TECHNICAL APPENDIX

The purpose of this appendix is to mathematically derive some of the effects of prohibiting the marketing order supply management provisions which were illustrated in the text. The linear demand relationships used in the graphs are explicitly identified and employed to quantify consumer surplus and revenue changes. The reader is directed to the appropriate graphical presentation to clarify the material presented here.

Shortrun Impact of Prohibiting Quality Restrictions

Define the demand for a commodity marketed under a size and grade order as:

$$(1) \quad P = f(Q, AQ, Z)$$

where:

P = price,

Q = quantity demanded,

AQ = some measure of the average quality of sales, with $\frac{\partial P}{\partial AQ} > 0$,
and

Z = all other demand shifters.

Simple linear demand expressions can be specified by incorporating Z and AQ into the intercept term. With the order quality restrictions in effect and Q_0 eligible for sale:

$$(2) \quad P_0 = \alpha_0 - \beta Q_0$$

Assuming $\frac{\partial P}{\partial AQ}$ is independent of Q , dropping the order standards results in:

$$(3) \quad P' = \alpha_1 - \beta Q_0$$

where the intercept change, $\alpha_1 - \alpha_0$, reflects the negative quality change. Quantity increases by R , previously restricted supplies, yielding:

$$(4) \quad P_1 = \alpha_1 - \beta(Q_0 + R).$$

The change in consumer surplus (corresponding to areas B + C in fig. 2) is:

$$\begin{aligned} (5) \quad \Delta CS &= (P' - P_1) (Q_0 + (Q_0 + R))/2 \\ &= (\alpha_1 - \beta Q_0 - \alpha_1 + \beta(Q_0 + R)) (2Q_0 + R)/2 \\ &= \beta R(2Q_0 + R)/2. \end{aligned}$$

This formulation indicates that the change in consumer surplus is positive. It is positively related to initial supply, as well as supply increases resulting from removing the quality restriction. Further, consumer gains are negatively related to demand elasticity--the change in consumer surplus is greater the more inelastic the demand function. Note that the extent of the parallel demand shift from the altered quality mix does not affect the change in consumer surplus.

The change in total revenue resulting from dropping the restriction is:

$$\begin{aligned}
 (6) \quad \Delta TR &= P_1(Q_0 + R) - P_0 Q_0 \\
 &= Q_0(P_1 - P_0) + P_1 R \\
 &= Q_0(\alpha_1 - \beta(Q_0 + R) - \alpha_0 + \beta Q_0) + R(\alpha_1 - \beta(Q_0 + R)) \\
 &= Q_0(\alpha_1 - \alpha_0) + \alpha_1 R - \beta R(2Q_0 + R).
 \end{aligned}$$

Hence, the impact on producers depends on the same factors affecting consumer surplus changes plus the magnitude of the quality-induced shift in demand. It is not clear from equation (6) whether the change in producer revenue is positive or negative. This depends on the relative magnitudes of the supply and demand shifts.

Combining ΔCS and ΔTR yields an expression for the net change in social welfare, ΔNSW associated with prohibiting marketing order quality restrictions:

$$(7) \quad \Delta NSW = \Delta CS + \Delta TR = Q_0(\alpha_1 - \alpha_0) + \alpha_1 R - \beta R(2Q_0 + R)/2,$$

which can also be written as:

$$\begin{aligned}
 (8) \quad \Delta NSW &= Q_0(\alpha_1 - \alpha_0) + R(\alpha_1 - \beta(Q_0 + R/2)) \\
 &= R \left(\frac{P' + P_1}{2} \right) - Q_0(P_0 - P').
 \end{aligned}$$

The two terms in equation (8) correspond to the shaded areas C + D and A, respectively, in figure 2. Note that whether net social welfare is positive or negative depends on the relative magnitudes of the supply and demand shifts. If R is large relative to $\partial P / \partial A Q$, the net change will be positive. If the reverse is true, producer loss will more than outweigh consumer gain.

Shortrun Impact of Prohibiting Flow-to-Market Provisions

Assume demand is represented by the simple expression (see fig. 3):

$$(9) \quad P = \alpha - \beta Q$$

With marketing order price stabilization, quantity $Q_0 = Q_T/2$ is allocated to each sales period, yielding $P_0 = \alpha - \beta Q_0$. Terminating the order results in unequal allocations of $Q_1 = Q_0 - \delta$ and $Q_2 = Q_0 + \delta$, with corresponding prices $P_1 < P_0 < P_2$.

In the shortrun, the change in consumer surplus resulting from prohibiting administrative stabilization can be calculated as:

$$\begin{aligned}
 (10) \quad \Delta CS &= \frac{(P_0 - P_1)(Q_0 + Q_1)}{2} + \frac{(P_0 - P_2)(Q_0 + Q_2)}{2} \\
 &= \frac{(P_0 - P_1)(Q_T - \delta) + (P_0 - P_2)(Q_T + \delta)}{2}
 \end{aligned}$$

$$\begin{aligned}
&= \frac{\beta(Q_1 - Q_0)(Q_T - \delta) + \beta(Q_2 - Q_0)(Q_T + \delta)}{2} \\
&= -\beta\delta(Q_T - \delta) + \beta\delta(Q_T + \delta) \\
&= \beta\delta^2.
\end{aligned}$$

This result, consistent with Waugh (17), shows that consumers benefit from destabilization. This benefit goes up at an increasing rate with δ , the amount by which the destabilized output deviates from the stabilized output. It also increases in direct proportion to price flexibility.

The change in producer revenue between the initial and revised conditions is calculated as:

$$\begin{aligned}
(11) \quad \Delta TR &= P_1 Q_1 + P_2 Q_2 - 2P_0 Q_0 \\
&= \alpha(Q_1 + Q_2) - \beta(Q_1^2 + Q_2^2) - 2\alpha Q_0 + 2\beta Q_0^2 \\
&= 2\beta Q_0^2 - \beta(Q_1^2 + Q_2^2) \\
&= 2\beta Q_0^2 - \beta(2Q_0^2 + 2\delta^2) \\
&= -2\beta\delta^2.
\end{aligned}$$

Combining consumer surplus and producer revenue changes yields:

$$(12) \quad \Delta NSW = -\beta\delta^2$$

Shortrun Impact of Prohibiting Market Allocation Provisions

Consider a simple two-market case of price discrimination with individual market demand curves:

$$(13) \quad P_A = \alpha_A - \beta_A Q_A, \text{ and}$$

$$(14) \quad P_B = \alpha_B - \beta_B Q_B.$$

Under discrimination, the shortrun fixed quantity is allocated to equate marginal revenues in the two markets:

$$(15) \quad MR_A = \alpha_A - 2\beta_A Q_A^0 = MR_B = \alpha_B - 2\beta_B(\bar{Q}_T - Q_A^0),$$

and solving for Q_A^0 and Q_B^0 yields:

$$(16) \quad Q_A^0 = \frac{\alpha_A - \alpha_B + 2\beta_B \bar{Q}_T}{2(\beta_A + \beta_B)}, \text{ and}$$

$$\begin{aligned}
(17) \quad Q_B^0 &= \bar{Q} - Q_A^0 \\
&= \frac{\alpha_B - \alpha_A + 2\beta_A \bar{Q}_T}{2(\beta_A + \beta_B)} .
\end{aligned}$$

Solving for the respective market prices:

$$\begin{aligned}
(18) \quad P_A^0 &= \alpha_A - \beta_A Q_A^0 \\
&= \frac{\beta_A \alpha_A + \beta_A \alpha_B + 2\beta_A \alpha_B - 2\beta_A \beta_B \bar{Q}_T}{2(\beta_A + \beta_B)}
\end{aligned}$$

$$\begin{aligned}
(19) \quad P_B^0 &= \alpha_B - \beta_B Q_B^0 \\
&= \frac{\beta_B \alpha_A + \beta_B \alpha_B + 2\beta_A \alpha_B - 2\beta_A \beta_B \bar{Q}_T}{2(\beta_A + \beta_B)} .
\end{aligned}$$

Individual market prices and quantities without market allocation are calculated by equating P_A and P_B :

$$\begin{aligned}
(20) \quad \bar{P} &= P_A^1 = P_B^1, \text{ or} \\
\alpha_A - \beta_A Q_A^1 &= \alpha_B - \beta_B (\bar{Q}_T - Q_A^1) .
\end{aligned}$$

Solving for Q_A^1 and Q_B^1 :

$$\begin{aligned}
(21) \quad \alpha_A - \beta_A Q_A^1 - \alpha_B + \beta_B \bar{Q}_T - \beta_B Q_A^1 &= 0, \\
Q_A^1 &= \frac{\alpha_A - \alpha_B + \beta_B \bar{Q}_T}{\beta_A + \beta_B}
\end{aligned}$$

$$\begin{aligned}
(22) \quad Q_B^1 &= \bar{Q} - Q_A^1 \\
&= \frac{\alpha_B - \alpha_A + \beta_A \bar{Q}_T}{\beta_A + \beta_B} .
\end{aligned}$$

The price in both markets, \bar{P} , can be determined by solving either equation (13) or (14):

$$\begin{aligned}
(23) \quad \bar{P} &= P_A^1 = P_B^1 = \alpha_A - \beta_A Q_A^1 \\
&= \alpha_A - \beta_A \left[\frac{\alpha_A - \alpha_B + \beta_B \bar{Q}_T}{\beta_A + \beta_B} \right] \\
&= \frac{\beta_A \alpha_B + \beta_B \alpha_A - \beta_A \beta_B \bar{Q}_T}{\beta_A + \beta_B} .
\end{aligned}$$

Subtracting prices with market allocation in effect from \bar{P} :

$$(24) \quad P_A^1 - P_A^0 = \frac{\beta_A(\alpha_B - \alpha_A)}{2(\beta_A + \beta_B)},$$

$$(25) \quad P_B^1 - P_B^0 = \frac{\beta_B(\alpha_A - \alpha_B)}{2(\beta_A + \beta_B)}$$

shows that terminating market allocation controls will reduce (increase) price in the market with the largest (smallest) demand curve intercept. Similarly, comparing market allocations with and without discrimination:

$$(26) \quad Q_A^1 - Q_A^0 = \frac{\alpha_A - \alpha_B}{2(\beta_A + \beta_B)}$$

$$(27) \quad Q_B^1 - Q_B^0 = \frac{\alpha_B - \alpha_A}{2(\beta_A + \beta_B)},$$

indicates quantity will increase (decrease) upon termination of controls in the market with the largest (smallest) demand curve intercept.

These price and quantity changes superficially imply nothing with respect to the relative elasticities of demand in the two markets. They are consistent, however, with the conventional condition that price discrimination in a two-market case raises price and reduces quantity in the market with the smaller (absolute) price elasticity of demand. This can be demonstrated by noting that with the linear demand curves used, at $P_A^1 = P_B^1 = \bar{P}$ (nondiscriminatory case), point elasticity of demand in market A, e_p^A , and in market B, e_p^B , can be calculated as:

$$(28) \quad \left| e_p^A \right| = \frac{\partial Q_A}{\partial P_A} \cdot \frac{\bar{P}}{Q_A^1} = \frac{1}{\beta_A} \cdot \frac{\bar{P}}{Q_A^1} = \frac{\bar{P}}{\beta_A Q_A^1}$$

$$(29) \quad \left| e_p^B \right| = \frac{\partial Q_B}{\partial P_B} \cdot \frac{\bar{P}}{Q_B^1} = \frac{1}{\beta_B} \cdot \frac{\bar{P}}{Q_B^1} = \frac{\bar{P}}{\beta_B Q_B^1}$$

$$(30) \quad \frac{e_p^B}{e_p^A} = \frac{\beta_B Q_B^1}{\beta_A Q_A^1}.$$

Substituting from the demand relationships, this ratio can also be written as:

$$(31) \quad \frac{e_p^A}{e_p^B} = \frac{\alpha_B - \bar{P}}{\alpha_A - \bar{P}}.$$

This equation shows that for $\alpha_A > \alpha_B$, price elasticity of demand in market A will be smaller (more inelastic) than in market B.

To assess the effect of market allocation on consumer surplus, the calculated price and quantity differences from above can be used to evaluate the shaded areas in figure 6. In a move from a situation of controls to one in which controls are prohibited, consumer surplus changes are calculated as:

$$(32) \quad \Delta CS_A = (P_A^0 - \bar{P}) \frac{(Q_A^0 + Q_A^1)}{2}$$

$$= \frac{\beta_A(\alpha_A - \alpha_B)}{2(\beta_A + \beta_B)} \left[\frac{4\beta_B \bar{Q}_T - 3(\alpha_B - \alpha_A)}{4(\beta_A + \beta_B)} \right]$$

$$(33) \quad \Delta CS_B = (P_B^0 - \bar{P}) \frac{(Q_B^0 + Q_B^1)}{2}$$

$$= \frac{\beta_B(\alpha_B - \alpha_A)}{2(\beta_A + \beta_B)} \frac{4\beta_A \bar{Q}_T - 3(\alpha_A - \alpha_B)}{4(\beta_A + \beta_B)} .$$

These equations show that market A (where price will drop with discrimination prohibited) will show consumer surplus gains, while losses in surplus will occur in market B (where price increases).

The net effect of prohibiting market allocation in the shortrun can be expressed as:

$$(34) \quad \Delta CS = \Delta CS_A = \Delta CS_B$$

$$= \frac{3(\alpha_A - \alpha_B)^2}{8(\beta_A + \beta_B)} .$$

This expression is positive and directly related to the extent to which the intercepts of the demand relationships that is, price elasticities from equation (31) differ.

In the shortrun, the change in producer revenue associated with prohibiting market allocation is calculated as:

$$(35) \quad \Delta TR = TR^1 - TR^0 = \bar{P}\bar{Q}_T - (P_A^0 Q_A^0 + P_B^0 Q_B^0)$$

$$= \left[\frac{\beta_A \alpha_B + \beta_B \alpha_A - \beta_A \beta_B \bar{Q}}{\beta_A + \beta_B} \right] \bar{Q}_T$$

$$- \frac{\beta_A \alpha_A + \beta_A \alpha_B + 2\beta_A \alpha_B - 2\beta_A \beta_B \bar{Q}_T}{2(\beta_A + \beta_B)} \left[\frac{\alpha_A - \alpha_B + 2\beta_B \bar{Q}_T}{2(\beta_A + \beta_B)} \right]$$

$$- \frac{\beta_B \alpha_A + \beta_B \alpha_B + 2\beta_A \alpha_B - 2\beta_A \beta_B \bar{Q}_T}{2(\beta_A + \beta_B)} \left[\frac{\alpha_B - \alpha_A + 2\beta_A \bar{Q}_T}{2(\beta_A + \beta_B)} \right] .$$

Combining terms and simplifying yields:

$$(36) \quad \Delta TR = \frac{-(\alpha_A - \alpha_B)^2}{4(\beta_A + \beta_B)} .$$

This equation shows that producers always lose from prohibiting market allocation.

Social welfare implications of prohibiting market allocation in the shortrun can be assessed by adding consumer surplus and producer revenue changes:

$$(37) \quad \Delta CS + \Delta TR = \frac{(\alpha_A - \alpha_B)^2}{8(\beta_A + \beta_B)}$$

The result indicates that in the shortrun, there is a net societal gain associated with prohibiting market allocation--consumer's gains offset producer's revenue loss by a factor of 50 percent.

Longrun Impact of Prohibiting Market Allocation Provisions

In the longrun, evaluation of the effect of market allocation orders on social welfare must consider supply effects. Specifically, unless supply is completely inelastic, quantity will decline with a prohibition on discrimination, since average grower returns will decline.

The shortrun fixed quantity, \bar{Q}_T , is associated with a price above the point of the intersection of supply and aggregate demand. That is, discrimination yields a weighted average price, $P_W = [(P_A^0 Q_A^0 + P_B^0 Q_B^0) / \bar{Q}_T]$, above \bar{P} , the shortrun equilibrium price without discrimination. ^{12/} When (P_W, \bar{Q}_T) is specified as one point on the longrun supply curve, the longrun equilibrium with discrimination prohibited is illustrated in figure 6. Given a supply curve, SS, with elasticity between zero and positive infinity, the equilibrium price, \bar{P}' , will lie between the weighted average discriminatory price, P_W , and \bar{P} , the nondiscriminatory price associated with the shortrun fixed quantity \bar{Q}_T .

The longrun change in net social welfare with market allocation prohibited is dependent on the elasticity of supply as well as demand. Examination of two extreme cases with respect to supply elasticity is instructive. If elasticity of supply is zero, quantity remains at \bar{Q}_T and price drops to \bar{P} . This is identical to the short-run case; prohibiting market allocation yields a positive change in net social welfare, since the increase in consumer surplus more than offsets the loss in producer revenue associated with the weighted price decline.

^{12/} Market allocation yields an average revenue curve which begins at the bend of the combined market demand curve in fig. 6 and lies above and to the right moving from left to right (see 7, p. 125; or 2, pp. 269-275). The vertical distance between this discrimination average revenue curve and the demand curve increases with quantity.

With infinite elasticity of supply, price remains at P_W , the weighted average price in the discriminatory case, and the entire effect of prohibiting discrimination is manifested in reduced quantity. The magnitude of this reduction depends on the price elasticity of aggregate market demand. Equilibrium quantity can be calculated by inverting the price-dependent individual demand relationships [equations (13 and (14))] and aggregating quantities:

$$\begin{aligned}
 (38) \quad \bar{Q}'_T &= \bar{Q}_A + Q'_B \\
 \bar{Q}'_T &= \left[\frac{\alpha_A - P_W}{\beta_A} \right] + \left[\frac{\alpha_B - P_W}{\beta_B} \right] \\
 &= \left[\frac{\beta_A \alpha_B + \beta_B \alpha_A}{\beta_A \beta_B} \right] - \left[\frac{P_W (\beta_A + \beta_B)}{\beta_A \beta_B} \right] .
 \end{aligned}$$

Combining the last two terms of equation (35) and dividing the sum by \bar{Q} yields an expression for P_W :

$$(39) \quad P_W = \frac{(\alpha_A - \alpha_B)^2}{4\bar{Q}_T(\beta_A + \beta_B)} + \frac{(\beta_A \alpha_B + \beta_B \alpha_A - \beta_A \beta_B \bar{Q}_T)}{(\beta_A + \beta_B)} .$$

Note from equation (23) that this can also be expressed as:

$$(40) \quad P_W = \frac{(\alpha_A - \alpha_B)^2}{4\bar{Q}_T(\beta_A + \beta_B)} + \bar{P} .$$

Equation 40 explicitly shows the shortrun price elevation attributable to market allocation.

Substitution of equation (39) into equation (38) yields a simplified expression for \bar{Q}'_T :

$$\begin{aligned}
 (41) \quad \bar{Q}'_T &= \frac{\beta_A \alpha_B + \beta_B \alpha_A}{\beta_A \beta_B} \\
 &\quad - \left[\frac{(\alpha_A - \alpha_B)^2}{4\bar{Q}_T(\beta_A + \beta_B)} + \frac{(\beta_A \alpha_B + \beta_B \alpha_A - \beta_A \beta_B \bar{Q}_T)}{(\beta_A + \beta_B)} \right] \frac{\beta_A + \beta_B}{\beta_A \beta_B} \\
 &= \bar{Q}_T - \frac{(\alpha_A - \alpha_B)^2}{4\bar{Q}_T(\beta_A \beta_B)} .
 \end{aligned}$$

Longrun equilibrium quantity with infinitely elastic supply will be less than the equilibrium quantity under discrimination by the amount $(\alpha_A - \alpha_B)^2 / 4\bar{Q}_T \beta_A \beta_B$.

With infinitely elastic supply, the longrun change in consumer surplus attributable to prohibition of market allocation can be expressed as:

$$(42) \quad \Delta CS_A + \Delta CS_B = \frac{(P_A^0 - P_W)(Q_A^0 + Q_A')}{2} + \frac{(P_B^0 - P_W)(Q_B^0 + Q_B')}{2}$$

P_A^0 and P_B^0 are defined by equations (18) and (19), respectively, and P_W is defined by equation (40). Q_A^0 and Q_B^0 are from equations (16) and (17), while Q_A' and Q_B' are derived by substituting \bar{Q}_T' for \bar{Q}_T in equations (21) and (22).

After extensive simplification, performing the operations noted in equation (42) yields the following expression for the net difference in consumer surplus:

$$(43) \quad \Delta CS = \Delta CS_A + \Delta CS_B = \frac{(\alpha_A - \alpha_B)^2 (2\bar{Q}_T - \bar{Q}_T')}{8\bar{Q}_T(\beta_A + \beta_B)}$$

which [from equation (40)] can also be written as:

$$(44) \quad \Delta CS = \frac{(2\bar{Q}_T - \bar{Q}_T') (P_W - \bar{P})}{2}$$

It can be seen from equation (41) that this expression is always positive. Prohibiting market allocation results in a longrun equilibrium solution yielding consumer surplus greater than under market allocation. Moreover, this conclusion holds for any elasticity of supply value in the zero to positive infinity range.

The longrun change in producer revenue associated with prohibiting market allocation when supply is infinitely elastic can be expressed simply as:

$$(45) \quad \Delta TR = P_W(\bar{Q}_T' - \bar{Q}_T)$$

which [from equation (41)] is always negative.

Summing the change in consumer surplus and producer revenue yields an expression for the change in net social welfare:

$$\begin{aligned} (46) \quad \Delta CS + \Delta TR &= \frac{(2\bar{Q}_T - \bar{Q}_T') (P_W - \bar{P})}{2} + \bar{P}_W(\bar{Q}_T' - \bar{Q}_T) \\ &= (2\bar{Q}_T - \bar{Q}_T') \frac{(\alpha_A - \alpha_B)^2}{8\bar{Q}_T(\beta_A + \beta_B)} + \left[\bar{P} + \frac{(\alpha_A - \alpha_B)^2}{4\bar{Q}_T(\beta_A + \beta_B)} \right] (\bar{Q}_T' - \bar{Q}_T) \\ &= \bar{Q}_T' \left[\frac{(\alpha_A - \alpha_B)^2}{8\bar{Q}_T(\beta_A + \beta_B)} \right] - \bar{P} \left[\frac{(\alpha_A - \alpha_B)^2}{4\bar{Q}_T(\beta_A + \beta_B)} \right] \\ &= \left[\frac{(\alpha_A - \alpha_B)^2}{8\bar{Q}_T\beta_A\beta_B(\beta_A + \beta_B)} \right] (\beta_A\beta_B\bar{Q}_T' - 2(\beta_A + \beta_B)\bar{P}). \end{aligned}$$

This expression is not very enlightening in the form shown. However, note from equation (38) that the price elasticity of the aggregate demand curve can be calculated as:

$$(47) \quad \left| e(\bar{Q}'_T, P_W) \right| = \partial Q_T / \partial P_W \left(\frac{P_W}{\bar{Q}'_T} \right) = \frac{(\beta_A + \beta_B)}{\beta_A \beta_B} \left(\frac{P_W}{\bar{Q}'_T} \right)$$

so that:

$$(48) \quad \beta_A \beta_B \bar{Q}'_T = (\beta_A + \beta_B) P_W \quad .$$

$$\left| e(\bar{Q}'_T, P_W) \right|$$

Hence, the net social welfare expression [equation (46)] will be positive if and only if:

$$(49) \quad \left| e(\bar{Q}'_T, P_W) \right| < \frac{P_W}{2\bar{P}} \quad .$$

In other words, the equation will be positive only if the price elasticity of demand evaluated at the longrun equilibrium price and quality is relatively inelastic.

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